

Clinical Science

Factors associated with 30-day unplanned pediatric surgical readmission



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Pediatric;
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Abstract

BACKGROUND: Unplanned readmissions are costly to family satisfaction and negatively associated with quality of care. We hypothesized that patient, operative, and hospital factors would be associated with pediatric readmission.

METHODS: All patients with an inpatient operation from 10/1/2008 to 7/28/2014 at a freestanding children's hospital were included. A retrospective cohort study using multivariable forward stepwise logistic regression determined factors associated with unplanned readmission within 30 days of discharge.

RESULTS: Among 20,785 patients with an operation there were 26,978 encounters and 3,092 readmissions (11.5%). Thirteen of 33 candidate variables considered in the stepwise regression were significantly associated with readmission. Patients with an emergency department visit within 365 days of operation, American Society of Anesthesiologists class 4 or greater, Hispanic ethnicity and late-day or holiday/weekend discharges were more likely to have an unplanned readmission (odds ratio [OR] = 1.96; 95% confidence interval [CI] = 1.76 to 2.19, OR = 2.00; 95% CI = 1.58 to 2.53, OR = 1.16; 95% CI = 1.04 to 1.29, OR = 2.27; 95% CI = 1.55 to 3.63, respectively).

CONCLUSIONS: Patient and hospital factors may be associated with readmission. Day and time of discharge represent variability of care and are important targets for hospital initiatives to decrease unplanned readmission.

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Thirty-day hospital readmission after an inpatient admission has long been used as a quality of care proxy predictive of successful transition of care after discharge.¹

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In June 2009, the Centers for Medicare and Medicaid Services (CMS) began reporting 30-day readmission rates for common adult diseases including myocardial infarction, heart failure, and pneumonia. With passage of the Patient Protection and Affordable Care Act in March 2010, CMS can decrease hospital compensation by up to 3% in 2015 based on an institution's expected vs observed 30-day readmission rate.²

Hospital readmission has not only been linked to quality of care provided to patients but is also a costly use of resources.³ Although there is a substantial body of literature

examining factors associated with readmission in the adult population,⁴⁻⁷ there has been little data published regarding readmission in the pediatric surgical patient population. Previous studies have examined specific patient populations susceptible to readmission and the variability of readmission rates across hospitals.⁸⁻¹⁰ Emerging data indicate that pediatric readmissions may not be as preventable as in adult populations.¹¹⁻¹³ Our study seeks to determine which factors present during an inpatient stay are associated with 30-day readmission at a freestanding children's hospital. Modifiable risk factors for readmission may allow for targeted interventions to help reduce hospital resource use and improve quality of care among pediatric patients.

Methods

Study design and primary outcome

We performed a retrospective cohort study using internal administrative data from a single, large, freestanding children's hospital. Data were obtained from the Seattle Children's Hospital enterprise data warehouse; a massively parallel processing database. The data warehouse is optimized for efficient reporting from more than 10 source systems including Cerner, Epic, and Allscripts. All data collected are heavily validated in a testing environment by subject matter experts before introduction into the production environment. In addition to the initial testing, exception based audit testing is performed and verified on a daily basis. All patients who had an inpatient operation between October 1, 2008, when the enterprise data warehouse became available, and July 28, 2014, were included in the analysis and examined for unplanned readmission within 30 days of discharge. Using the method described by Berry et al,⁸ a single unplanned readmission within 30 days of the day of discharge from the index hospitalization was counted as a readmission. If the patient was subsequently admitted or had a 2nd inpatient operation within 30 days of discharge, this was not counted as a 2nd readmission or as a new index operation.⁸ After the 30-day period, if the patient had another inpatient operation, this was counted as a new index case.⁸ Index operations were defined as procedures requiring anesthesia and an incision. All patients were designated as inpatient during their index encounter and for readmission.

To limit our analysis to patients with unplanned readmissions, patients were excluded if the index operation consisted of a diagnostic procedure such as a biopsy. This was done because many diagnostic procedures are followed by planned and appropriate operative intervention. In addition, patients were excluded if they had placement of (1) a temporary or permanent central venous catheter or (2) a peripherally inserted central catheter (as these patients were frequently admitted soon after their procedure for planned administration of chemotherapy). Another strategy used to capture unplanned events was to limit reoperative

readmissions to those related to the index operation. Unrelated surgical procedures were identified and excluded by a trained medical professional (M.K.R.). For example, if the index case were an appendectomy and the patient was readmitted within 30 days for a tonsillectomy, this was not counted as an unplanned readmission. A patient could have multiple index events, but they were required to be at least 30 days apart.⁸ Emergency department visits within 30 days of discharge from the index encounter that did not have an inpatient admission were not counted as readmissions.

Covariables and analysis plan

In the analysis, factors associated with unplanned readmission were examined using a forward stepwise logistic regression. The forward stepwise logistic regression model was used to select the predictors that were most significantly associated with readmission. Table 1 includes demographic characteristics of the patient population. Table 2 includes all significant characteristics identified in the stepwise regression model. Table 3 lists all characteristics deemed to be not significantly associated with unplanned readmission. Characteristics were considered significantly associated with unplanned readmission if their *P* value was less than 1 %. The more stringent *P* value of 1 % was used to account for type I error that may be associated with multiple testing. Wald test statistics were used to determine statistical significance for characteristics originally included in the stepwise regression model.

Predictors included in the model were related to patient characteristics, delivery of care, and hospital level factors. For example, patient characteristics included age, race, ethnicity, and primary language. Delivery of care consisted of factors such as the surgical division that performed the index operation, the hospital service, which represented the primary specialty that cared for the patient as an inpatient. Another factor related to care delivery included the operating room where the index operation took place. Although these are generally grouped by subspecialty, this is not exclusive. Operating rooms have varying equipment, and structural layouts, which may be additionally related to the risk of readmission, beyond the type of cases typically performed in each operative suite. Hospital level factors included predictors such as the time of day and day of week of discharge, the number of bed transfers during the inpatient stay and the amount of nonoperative time between the cases. Variables were excluded from the model if collinearity was present. This study was approved by the Seattle Children's Hospital's Institutional Review Board. Analysis was carried out using Stata Statistical Software (Release 12; StataCorp LP, College Station, TX).

Results

Over the study period from October 1, 2008 to July 28, 2014, there were 20,785 patients who had 26,978 index

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